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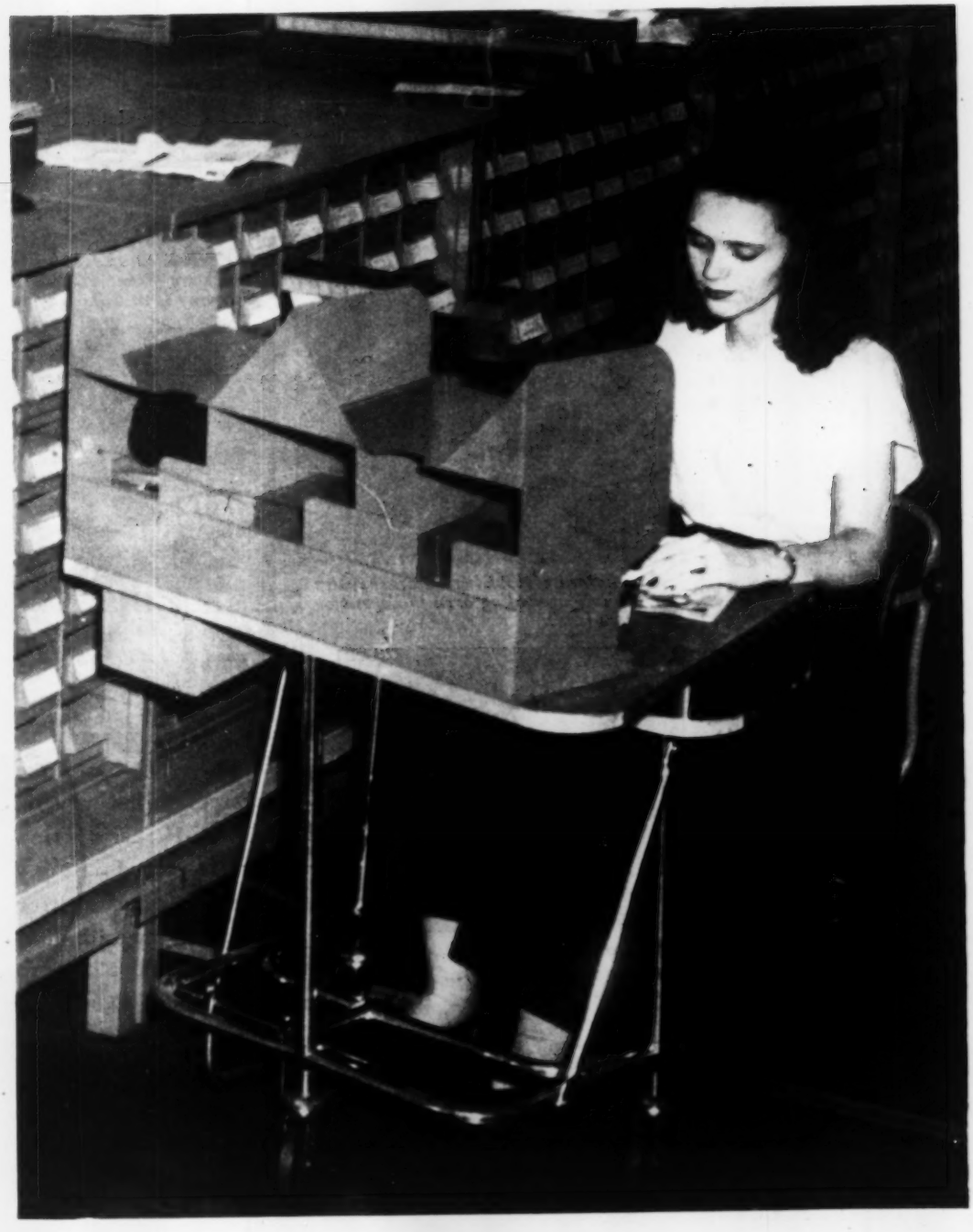
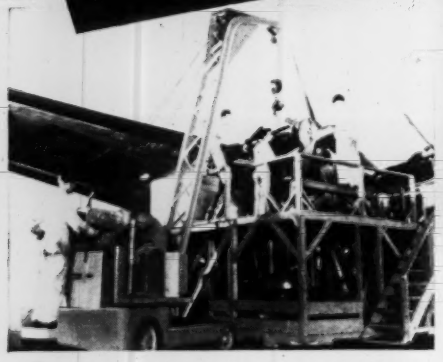
The Journal of INDUSTRIAL ENGINEERING

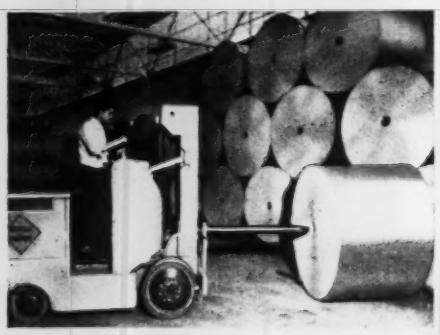


Vol. III No. 2 August, 1952

TEN TRICKS *with* TRUCKS

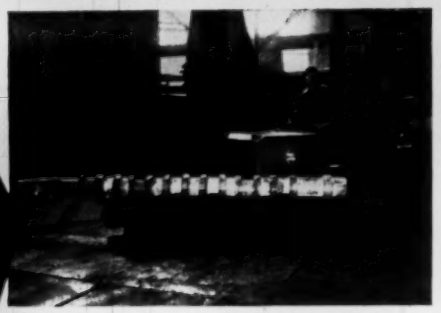


1. *E-P crane lowers bomber engine into place. Twice as fast as previous method, with less labor.*

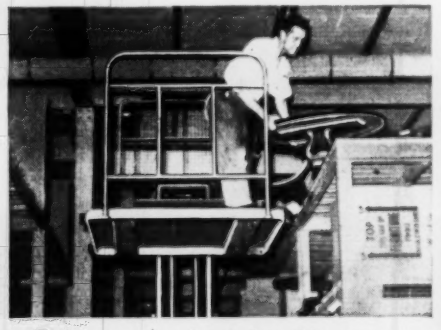


2. *E-P fork truck picks up rolls on ram—even high tiered rolls—with but ¼" difference in size of ram and hole.*

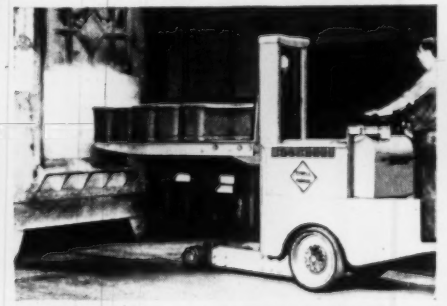
3. *High stacking huge tires with Elwell-Parker fork truck—a skillful operation.*



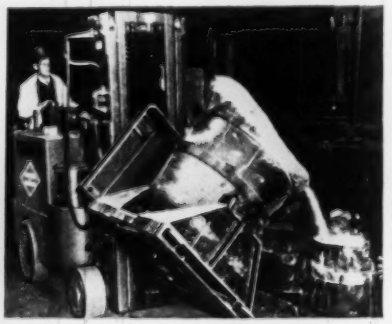
4. *Forged crankshaft, still at luminous heat, safely handled on skid by Elwell-Parker low lift truck.*



5. *Remote control switch enables operator to use fork (with safety steel platform) as elevator. This saves aisle space.*



6. *Platform of this Elwell-Parker enters right into annealing oven to deposit or remove loads.*



7. *E-P Rotary Device permits molten metal to be poured with ease and safety.*

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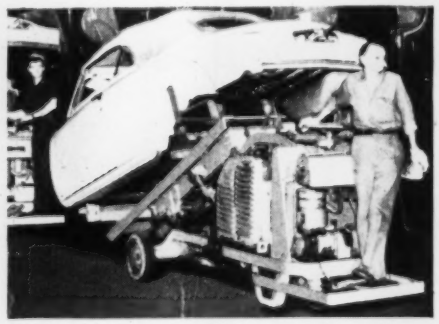
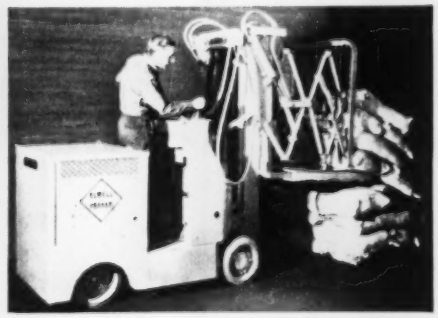


9. *Trucks carry auto bodies, also upend and store them vertically, to get 3 times as many in same floor space.*



10. *Special E-P device retrieves pallet when load is deposited.*

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President's Message

M. A. PAYNE

We are frequently asked to compare the objectives of the American Institute of Industrial Engineers with those of other groups interested in scientific and industrial management and related fields. We are asked if there is a clear line of demarcation between objectives. While the answer given below is my own, I believe it is shared by a good many of the officers and members of the Institute.

It is not the intention of A.I.I.E. to compete with or duplicate the efforts of other groups. If such were our purpose, we would have no reason for existing. Our objective is to do something for the Profession of Industrial Engineering which no other group can do because it is something Industrial Engineers must do for themselves.

A.I.I.E. admits to its membership only qualified, professional Industrial Engineers. We recognize there are other societies to which these same men may and often should belong with great profit to themselves and society. But first as Industrial Engineers they have a basic interest in, and responsibility to, their profession, a responsibility which transcends their general or particular interests in this field as represented by other groups. If an Engineer fails to recognize this obligation and the need for an institute in which he can participate actively and aggressively, and in which he can work to strengthen, improve and gain recognition and acceptance of the principles of his profession, then there is serious doubt whether that man is a

(Continued on Page 14)

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THE COVER

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Editor's Column

As this column is being written one of the great political conventions is in full swing. The confusion, bitterness and even apparent hate is widespread. An outsider may not realize that this is American democracy in action.

Out of this turmoil will come a leader, probably not the best that is available, but the best who could win the necessary support. There will always be a small percentage of disgruntled non-supporters of new leadership who will be small enough in their future actions to make it hard for any new chief to carry out the wishes of the majority. By and large, however, most of the temporary opposition will rally to the winner and all will work together for their common good.

These same principles apply to any organizational situation, large or small. As long as disagreements are kept on a friendly and impersonal basis no permanent or prolonged damage will result. It should also be borne in mind that the majority group may be the one out of step. The stand of the minority is often correct, particularly when viewed in its long-term aspects. The fact that the groups becomes a minority should be a warning to them to carefully re-evaluate their position. On the other hand if the minority group still feels that their position is sound they owe it to the majority to stand pat and continue reasonable and diplomatic pressure to bring out the soundness of their disagreement. Much outstanding good is started and sometimes finished by sound minority action.

Changing the subject rather abruptly is necessary to allow space for "posies" to the Atlanta Chapter. Why? For appointing a Publicity Committee to assist the Business Manager of the JOURNAL in carrying out an advertising campaign. Your chapter can help too—don't ask why, just get busy!

A CHALLENGE TO CHAPTERS

Excellent material is being omitted from the JOURNAL because of lack of space. For each additional page of advertising we can add two or three additional pages of articles or other features. If each chapter will assume as a project the securing of one page of advertising we can double the size of the JOURNAL. The Cleveland Chapter has done it again; will you meet this challenge?

The Changing Concept of Industrial Engineering

By Ralph M. Barnes

Professor of Engineering and Production Management, University of California, Los Angeles, as presented to the American Institute of Industrial Engineers, National Convention, May 10, 1952.

The first half of the Twentieth Century in all probability will go down in history as the era of greatest progress in industrial productivity. Enlightened management has come to realize that part of this productivity has resulted from the work of the industrial engineer. In turn, the industrial engineering profession has increased its stature to such an extent that it has taken on new importance and responsibility which is recognized by all concerned in business and industry.

The vast majority of progressive industries employ industrial engineers, and, in most cases, have a comprehensive industrial engineering program. The results of an Industrial Engineering Survey which I made showed that the number of people employed in the industrial engineering department per thousand factory workers doubled during the period from 1945 to 1948. It is also interesting and significant that the majority of these departments are manned by college graduates.

I want to discuss several reasons why I think management is recognizing the industrial engineers' proper place in industry today, and to suggest some things we as engineers can do to accelerate this acceptance. Industrial engineering is undergoing a real change in this country.

1. The industrial engineer is a higher calibre man with better training than formerly. To be successful, an industrial engineer must have certain traits and characteristics. He must be interested in and be able to get along with people. He must be a good salesman. He must be honest and have the ability to defend his position when under pressure. He must know the fundamentals of industrial engineering, and it is desirable for him to be familiar with the technical and shop conditions of the business in which he is working.

An increasing number of industrial engineers are coming from our colleges and universities. Although a man from the shop with adequate training may meet the qualifications I have enumerated above, some of our most progressive organizations are increasing the percentage of college men in their industrial engineering departments. Moreover, men with a broad background in liberal arts or business administration are being included in this group. In fact, some organizations are employing men with an Engineering degree and a Master's degree in Business Administration so they will have the benefits of technical training in engineering and a broad understanding of business principles. The director of industrial engineering in a large company in the East recently informed me that 90 percent of the 200 people in his department are college graduates. As a further example, one manufacturing company with extensive welding operations has undertaken a study of welding methods, and a program of establishing time values for synthetically determining time standards on all welding work. A group of the most competent industrial engineers in the company were assigned to this study which has lasted over a year. The group consisted of both graduate industrial engineers and expert welders from the shop who had several years of training and experience in the industrial engineering department of this plant. This made an ideal team for this particular job.

Industry is employing men with rigorous academic training and is then thoroughly indoctrinating them in the companies' own methods and procedures, and is giving them a knowledge of the plant procedures and shop operating conditions.

2. The industrial engineer takes a broader view of the services that he renders. Now, technicians and time study clerks are being replaced with trained industrial engineers with wider vision of the functions of industrial engineering. The chief industrial engineer has a place as a member of top management planning groups. He is active in developing plans for company expansion, new products, new plants, and he makes his contribution in developing policies and procedures in connection with all phases of the business as it pertains to production. He aids in the preparation of labor contracts and is consulted in connection with labor problems.

In the past, the industrial engineer has been primarily concerned with increasing the productivity of the direct factory workers. However, with the increasing complexity of modern industry, particularly the larger producers of complicated products, the productivity of direct factory labor is only one of the many areas of concern to the industrial engineer. He must broaden his interests and attack such problems as utilization of plant, equipment and materials; measurement and control of yield, efficiency and quality of product; and the analysis of all so-called non-productive labor groups in the factory, office and service departments. Direct factory labor will offer the industrial engineer fewer and fewer opportunities, while these other areas will increase in importance. Of course, so long as workers are employed in industry, we are concerned with their productivity. Until the push-button factory eliminates the worker, direct labor will be a factor in the cost of a manufactured product.

The factory worker in America today is better educated, better paid, and has more leisure time than formerly. He is motivated in a different way than was the factory worker of twenty-five or fifty years ago. The industrial engineer should become a student of the advanced thinking in the area of human motivation and human relations. One of his duties is to aid in organizing things in the plant so that the worker will contribute fully of his ideas and energies and will find personal satisfaction in doing this. This is an assignment that calls for both broad training and a new approach on the part of the industrial engineer.

3. An increasing number of industrial engineers recognize the difference between the *line* position and the *staff* position in industry, and are willing to assume their place in the staff organization of which they are a part. The industrial engineer is the consultant, adviser and assistant to the line organization. He must assume the attitude of one who provides a service. The line organization is responsible for the operation of the plant. The industrial engineer should not interfere with the line organization and should not attempt to take credit for successes in this area.

4. The industrial engineer is improving his methods and techniques. He is now able to do a better job than ever before. With higher calibre men who have broad basic training, industry is able to indoctrinate them into the company's particular methods and techniques quickly and more effectively.

The physical equipment which the industrial engineer uses has greatly improved. Apparatus for recording and measuring data is generally available. Motion picture cameras capable of operating at normal, subnormal and high speed, together with suitable projectors for analyzing the film are widely used. In addition to the stop watch, the "Servis Recorder," tape recorder, electric counters and production recorders, are available. Calculating machines and computers for handling punch card data are in use. Adequate office space, conference rooms, and research and development laboratories facilitate the work of the industrial engineer.

An increasing number of industrial engineering departments now have developed industrial engineering manuals for use by members of their own departments and have shorter "Handbooks" for foremen and for the workers.

The industrial engineer is receiving more rigorous training in mathematics and statistics, and this is being reflected in his work. Both management and labor are insisting that the industrial engineer not only do an acceptable job, but that he be ready and willing to present adequate data to support his conclusions. Of course in the well managed industrial engineering departments this has always been the accepted procedure, but today, careless and slip shod habits on the part of industrial engineers are not tolerated.

An increasing number of companies are doing research work in the field of industrial engineering in order to improve their methods and techniques. One company in the Midwest has for several years been spending $50,000 per year on research in time study methods. Another company has men working on what might be classified as pure research. One of these men is looking into the whole subject of motivation and factors affecting the reasons why people work. Within the past year, one of the large farm implement companies has set up an industrial engineering research division, separate and apart from the central industrial engineering activity, in order to acquire new knowledge that will be beneficial to the company.

5. The industrial engineer is taking a more active part in professional organizations. The A.I.I.E. along with other national and local professional organizations provide opportunities for the industrial engineer to increase his knowledge, gain experience in working with other people, contribute his ideas, and aid in research projects that the group may undertake. Moreover, a professional group can contribute enormously in improving the status of industrial engineering in a community. For example, in one industrial area of some 150,000 total population, in a period of one year, the advent of a local industrial engineering society brought together the industrial engineers in the area for the first time. Several of the industries in the area were highly competitive and it had not been common practice for the industrial engineers to exchange ideas and information freely. The group first met to participate in a Work Measurements Survey, and at the insistence of a majority of the group an organization was formed at the conclusion of that meeting. Monthly sessions have been held since that time. The benefits of these meetings are numerous, both to the individuals and to the companies they represent. Engineers generally have been well aware of the benefits of membership in professional organizations, but it seems that the industrial engineer has not joined in such activities as fully as he should.

6. The industrial engineer can profit from advanced training in his own and related fields. There are many avenues by which the industrial engineer can further his training as he moves ahead in his profession, and I want to mention two of these here.

College courses on the campus or extension courses are now available in many of our cities, and such courses often mean more to a man after he has had experience in industry. This is one way in which a person can broaden his knowledge and interests.

The industrial engineer should participate in seminars, short courses, and conferences at frequent intervals. Such sessions differ from regular college courses and professional meetings, inasmuch as they provide an opportunity for a person to become well acquainted with other people confronted with similar problems. Ordinarily such seminars are intensive in nature and extend over a period of several weeks. To be most effective, short courses should have well-defined objectives, should be manned by a competent and experienced teaching staff, and should be attended by people of similar experience, interests and background. The course should be well integrated with ample time for round-table discussions and informal "bull sessions." The three-week Management Course started at the University of Iowa in 1939 was one of the first courses of this kind to be held on a college campus. Now, fortunately, such courses can be found in nearly every industrial state in the country. Some are sponsored by colleges and universities, others by professional societies, management associations and by private consultants and business concerns. The value of such seminars and short courses has been demonstrated so completely that their continuation and expansion seems assured.

7. The industrial engineer is improving his sales ability and is learning how to speak and write convincingly. He is learning the importance of communication facility. The engineer has been notable for his inability to put his ideas across. It seems that in many instances he has not been interested in gaining acceptance for his ideas. Rather, it has been his wish to solve the problem technically, and to expect others to do the selling for him. Most businessmen recognize that the industrial engineer's job is only partly done when he solves a technical problem. It is completed only after he has persuaded the people concerned to use his idea as he developed it and to obtain the savings which he predicted would result from the adoption of the idea.

Colleges and universities are giving more and better instruction in communications skills and industry is continuing the training in this area. Some companies now have courses in "selling ideas" designed especially for industrial engineers. Of course many engineers on their own have taken evening courses in public speaking and some professional societies have study groups devoted to this subject.

Many of our great business and industrial leaders have demonstrated the fact that to succeed as an individual a person must have great enthusiasm and interest in the thing he is doing, he must have imagination, inventive ability and originality, and in addition,

(Continued on Page 19)

HOW ACCURATE IS THE STOP WATCH?

By Robert N. Lehrer

Associate Professor, School of Industrial Engineering, Georgia Institute of Technology

Much controversy still exists among time study writers and practitioners concerning the relative advantages of the continuous and snap-back methods of taking time study readings. The proponents of the two watch reading methods have numerous claims which indicate the superiority of their favored method. Many of these claims are quite valid, but how about the accuracy of these two methods?

One of the more complete studies of the relative accuracy of watch reading methods was conducted by Irwin Lazarus,[1] and resulted in the following statement:

> "It may be concluded that in the hands of a competent, experienced industrial engineer both the snap-back and the continuous methods of watch reading yield equally good results for all practical purposes. However, for relatively untrained personnel and for those with a lower level of skill in watch manipulation, it would seem that the continuous method yields more consistent results of lesser mean error."

This statement might well indicate that the selection of the timing method to be used in any particular plant or for a particular study should be based upon the time study man's experience and the nature of the work to be studied.

Mr. Lazurus's investigation consisted in presenting a series of one-hundred predetermined time intervals to fifty experienced, practicing time study engineers to be timed by the method they normally used. Thirty-seven of the engineers used the snap-back method and thirteen of them used the continuous method. All of the engineers used their own decimal-minute stop watches, which were reported to have been jeweler-checked prior to the timing.

The one-hundred time intervals ranged from .0417 to .2593 minutes in length. Half of the elements ended with a visual stimulus (light flash) and half with an audible stimulus (buzzer). All of the element end points were preceded by a warning signal.

TABLE 1

Summary of Magnitude and Variability of Watch Reading Errors (from Lazarus)

	Continuous Timing	Snap-back Timing	
Visual Stimulus			
number of readings	634	1794	
mean error	+.000097 minutes	—.000820 minutes	Significantly different from one another at the 2% level of confidence
significantly different from zero?	no	yes (at the .002% level of confidence	
standard deviation of errors	.00813 minutes	.00808 minutes	Not significantly different from one another
Audible Stimulus			
number of readings	642	1848	
mean error	+.000587 minutes	—.000176 minutes	Not significantly different from one another
significantly different from zero	no	no	
standard deviation of errors	.00617 minutes	.00514 minutes	Significantly different from one another beyond all reasonable doubt

TABLE 2

Accuracy of Watch Readings for Various Element Lengths with Visual End Points (from Lazarus)

Element Length (Minutes)	Average Element Length (Minutes)	Continuous Number of Readings	Continuous Error (Minutes)	Continuous Error (%)	Snap-Back Number of Readings	Snap-Back Error (Minutes)	Snap-Back Error (%)
.040 to .061	.051	97	+.002083	+4.08*	286	+.000060	+0.12
.062 to .083	.073	125	+.002329	+3.19*	313	+.000159	+0.22
.084 to .105	.095	127	—.000218	—0.23	364	—.001199	—1.26*
.106 to .127	.117	65	—.000437	—0.37	185	—.000811	—0.69
.128 to .149	.139	62	—.001244	—0.89	182	—.000266	—0.19
.150 to .171	.161	38	—.000158	—0.10	110	—.001365	—0.85*
.172 to .195	.183	52	—.003277	—1.79*	136	—.002063	—1.13
.194 to .215	.205	13	—.000485	—0.24	37	+.000511	+0.25
.216 to .237	.227	13	+.000254	+0.11	37	—.002573	—1.13*
.238 to .259	.249	52	—.001661	—0.67*	144	—.002170	—0.87*
TOTAL			—.002814	+3.09		—.009717	—5.53
AVERAGE			—.000281	+0.31		—.000972	—0.55

*Mean Errors Significantly Different From Zero At the 5% Level Of Confidence

Although this investigation did not precisely duplicate the typical time study situation, it was designed to parallel the normal time measurement situation under closely controlled experimental conditions. Sufficient data were gathered to allow valid statistical analysis.

A summary and regrouping of Lazarus's results is presented in Table 1. The Mean Errors are the arithmetical averages of the individual readings minus the actual time values. It will be noted that the Mean Errors are very small, and are positive for continuous timing and negative for snap-back timing. Any conclusions based on the Mean Errors would very slightly favor the continuous method. The Standard Deviation of the errors, which indicates the variability of the time measurements, are essentially equal for both methods of timing. It is interesting to note that the magnitude of the Standard Deviation of the errors would indicate that about half of the individual watch readings by both methods (for the visual stimulus) would be in error by more than .005 minutes. The results also indicate that the snap-back method has a slight edge over the continuous method with audible end points.

Lazarus also grouped his data to investigate the relationship of watch reading errors wtih element length, for

(Continued on Page 18)

[1] Lazarus, Irwin P., "The Nature of Stop Watch Errors Among Experienced Industrial Engineers." Master of Science in Industrial Engineering Thesis, Purdue University, 1956.

Why Work Simplification In The Office?

By W. C. Perry

Assistant Vice President, Retail Credit Co., as presented to the Office Work Simplification Short Course, Georgia Tech, May 1, 1952

Last July the New York Times quoted the president of the Systems and Procedures Association of America as emphasizing "that productivity in office work has not kept pace with productivity in factory work, although many of the same principles of analysis can be used to economize on office overhead expeditures."

Why does this difference exist? Some reason that:

1. Increases and decreases in factory costs are apparent almost immediately;—not so in office work.
2. Errors in a manufactured product result in scrap and waste—visible, weighable, determinable; —errors in office work are usually corrected but the cost is not as evident—it is hidden and overlooked.
3. Generally more standards have been developed for factory work as to how a job is to be done and a measurement of production set up; as against so much office work done in a casual manner and frequently no standards of performance have been set.
4. Factory people do much repetitive work and it is evident that even a slight saving in a highly repetitive operation results in considerable total savings; whereas it is erroneously claimed that office work is considered to have insufficient repetitive elements and doesn't furnish a fertile field.

Please note that I said some people reason along these lines. Those who do are weakly excusing the lag in office Work Simplication,—they are not justifying it. We accept that not only is it desirable in the factory but further is an economic necessity. I submit that it is also an economic necessity in the office.

As a business man, I have three distinct general thoughts about Work Simplification in the Office:

1. It is an economic necessity for successful business management.
2. While some progress has been made there is so much more to be done with resultant savings and "easy pickings."
3. There is a need for simplifying Work Simplification. Too many people talk about it and think about it as a broad intangible without a specific crystallization of perspective which would turn the intangible into a tangible.

These observations, if correct or only partly so, mean too few people recognize "Why Work Simplification in the Office." So it should be talked about from every conceivable approach — general and specific; its merits; its benefits; and not only Why it should be done but also How it can be done so that more people have a thorough understanding of What it is, Why it is good, and How it can be done. The whole package must be considered to create a thirst for it; motivate participation in it; and develop anticipation of the rewards of benefits from it.

My own business responsibilities, coupled with work in a Management Association has resulted in my own self appointment as a Missionary to spread the Gospel of "Why Work Simplification in the Office."

Let us for the sake of interpretation and understanding reach a common ground of approach. What is Work Simplification? Different definitions add up to the same approximate conclusion. A concise one I like to use is,

> Elimination of all non-essential work, and improving the manner in which all essential work is performed—*making it easier*.

Keep that in mind in our developing the "Why." One further thought. Simplification is a philosophy. It's a policy, a belief, an understanding and a searching soul and mind, ever present, that there are ways and means to save time, save effort, save money. It is a philosophy just as medical men have a philosophy that they can heal the sick. Techniques are the means to that philosophical end. They themselves are not Work Simplification, they are the means and patterns for methodical exploration, methodical thinking and methodical deduction to get simplification accomplished. They are extremely important but first we must accept the philosophy, live it and act it. I think of it as positive dissatisfaction with the status quo. Just being dissatisfied is not enough, but being dissatisfied with the belief and approach that desirable changes can be made, that work can be made easier, than time can be saved, is highly positive. It is that philosophy which combined with the techniques of Work Simplification results in the satisfaction of creative, valuable accomplishments.

In a preaching way, (I warned you, I am a self-appointed missionary) and an extremely general way that is an answer to "Why Work Simplification in the Office?"

That is a "wordy" answer. Let's get down to bed rock, understandable economic reasons.

What are the Chief components we deal with in Office Management? Minutes, Money, Manpower (including Womanpower). Anything which favorably affects any one of these, during these days of high costs, manpower shortages, extra loading of clerical effort, is a desirable thing to do. Does work simplification in the office have any effect on these? Let's see.

MINUTES: — (TIME). Regard time from two viewpoints:

1. The time required to turn out work, which of course overlaps with the money category too, and
2. Regard time from the viewpoint of completing work when it is needed or soon enough to be of maximum value.

Doing specified jobs in less time results in material savings.

The second point in respect to time, getting out work soon enough, may not be quite clear. Let me clarify it with a specific illustration. The Company with which I am connected operates throughout the U. S., Canada, Mexico, Hawaii, Puerto Rico and Cuba. We have 159 branch offices. Our business is one of small margin of profit and costs must be controlled carefully. We do this by breaking down the dollar of revenue into items of cost. I should say we split the cent rather than the dollar, for our costs in each category are figured to mills. Each office has its cost standards. If they do not live within them, our financial results suffer. As soon as they

exceed the standard, the situation must be corrected as soon as possible. Following each calendar month a detailed cost report is furnished each of our 159 managers showing the cost detail on each item for that month. This is a big time-consuming job. Until five years ago it took until the 21st of the succeeding month to complete the reports. If an unsatisfactory condition had arisen it was not in the manager's hands until the succeeding month was almost over so the poor results would run for two months before correction. The problem was evident. Get the information to managers in shorter time. Through methodical study and work simplification approach the reports are now ready at the end of the fourth working day following the end of the month—not by adding to the force; not by putting in periods of overtime; but through applying principles of work simplification. To us a real advantage.

Let's move over to a closely related component—MONEY. Bear in mind that business is not built around the office but rather the office is an appendage to serve the business. It is an added cost. Keep the cost down and the business is served better. The purpose of Work Simplification—to eliminate non-essential work and improve the manner in which the essential work is performed—is to keep work at a minimum. The less work, the less cost.

A friend of mine participated in group discussional meetings we conducted 1½ years ago on Work Simplification. His attendance was timely for he was troubled by a problem. He had a unit of 20 girls spending all their time typing reference form letters. These letters had to be addressed to the person to whom the letters went and in proper spaces had to be inserted the name, addresses, and identification of the person inquired about. His problem was to handle the same volume of work with 18 girls instead of twenty. At this first meeting the discussion centered on the philosophy of Work Simplification. That work can be made easier—that non-essentials can be eliminated. He knew nothing of techniques. Fortified only with the philosophy, the next day he worried again about his problem. He reviewed some of the letters—just using his head to solve a problem. He wondered if all the punctuation marks, which are strokes on the typewriter, were needed. He felt that initials would suffice instead of spelling out full given names, he noted that many abbreviations could be used and came to the conclusion that the amount of key stroking could be reduced materially. He selected one girl to try out his simplified approach. He had production standards. Comparison showed increased production of 14%. Then other girls were switched over, with a corresponding increase in production. Result: 18 girls turning out the volume which formerly required 20 girls, and the results from a quality angle were not impaired.

Ask him "Why Work Simplification in the Office?" and he'll answer—Money. He'll answer doubly money, for there is an interesting sequel to this specific example. Upon the insistence of his boss, the idea was sent to Washington (he being employed by a Government agency) and subsequently he received a check for $50.00 for his suggestion. So you can understand why he says it pays and pays, and pays.

That brings us up to our third and final component. This component is in my mind the most important. People represent the largest item of cost in the office; results depend upon them—their ability, their willingness, their spirit, their morale. They are the office. Any influence upon them which is a good influence, is good for the office and the business. Conversely any influence which reacts negatively upon them is poor for the office and the business. We can and must do more with and for the human element. People are individuals with all the complex make ups of individuals. They work as a means to an end—satisfactory living. They have innate characteristics; you and I have them. What are they? We have:

Hopes, aspirations and ambitions, as well as fears and apprehensions;

We have a strong yearning to be depended upon, to feel needed, to feel important, as well as a sensitivity to neglect and being relegated to unimportance;

We have a sense of pride that we are better than, certainly as good, as the next; and a worry we may not be so regarded.

We have a determination of our worth—too often, more than we are being paid—and a concern that those who can are not making our value greater.

Introspection will bring to your mind many others. Isn't it too bad that we don't more often regard people with whom we work as reflections of us in respect to our emotions, aspirations, sensitivities, pride, etc.? If we realized it our human relations—in business termed employee relations—would be so much better.

If we can appeal to the human characteristics we get better response from people, better performance, better quality and of course, lower costs. It is in this realm that there is a strong positive answer to "Why Work Simplification in the Office"?

In 1947 the National Industrial Conference Board conducted a study among several thousand clerical workers in respect to factors influencing employee morale. The first five factors should be considered in respect to our subject.

1. *Opportunities in the Company for advancement:* People generally feel they progress faster in a progressive company, a company practicing Work Simplification in the employees mind is ear marked as being progressive; Work Simplification leads to setting standards so the employee, because of it, is more likely to be impressed that the how and what of other jobs are being laid out and by standards, resulting from Work Simplification, his merits may be more truly measured and his attitude toward opportunities is more wholesome than in a "by chance" operated business.
2. *Job Security—Employment Stabilization:* The business and the job must be long lasting. People will sense that a plan of Work Simplification puts their company in a desirable competitive situation, it shows the company knows its business and the importance of the job is emphasized.
3. *Compensation:* Whether people want or expect a lot for nothing the fact remains that compensation is in ratio to performance. The essence of Work Simplification is to get performance improved, a direct positive influence on ability to hold up compensation.
4. *Type of Work:* This will be

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DUTIES OF TIME STUDY ENGINEERS

By Robert Andrew Jacobs

Graduate Student in Industrial Engineering, Purdue University

A survey was made of the time study personnel in twenty-five firms in the Indianapolis area in an attempt to define the occupation, Time Study Engineer. Personal interviews were used to gather information concerning the duties and responsibilities of time study engineers, the areas in which time study engineers were inadequately trained, and the factors involved in cases where short comings of time study personnel resulted in transfer or dismissal.

The survey results indicate that:

1. Although the twenty-five companies have a total of eleven different titles for the person who functions as a time study engineer, they agree to a surprising extent as to the duties and responsibilities that belong to the position.
   a. In the original check list of duties and responsibilities there were a total of nineteen items.
   b. Of the twenty-five companies surveyed over two-thirds of the companies included the same list of thirteen duties and responsibilities as part of the functions of their time study engineer.

2. From the question that concerned the factors contributing to the failure of personnel in time study engineering positions, the writer found that 72% of the supervisors mentioned factors related to human relations, 48% of the supervisors mentioned problems related to the personal problems of time study engineers, and 28% of the supervisors mentioned factors related to technical problems.

3. The following compilation is a composite job description for the job, time study engineer, based upon the data gathered in this survey. Only duties and responsibilities assigned to the time study men of 33% or more of the twenty-five companies included in the survey are included in the composite job description. All twenty-five companies have time standards of some type.

TIME STUDY ENGINEER. Conducts stopwatch time studies; analyzes own time studies and establishes rates; determines best methods for operations; develops standard data charts; analyzes material handling problems; discovers causes of excessive down time; discovers causes for subsidizations where operator fails to make day rate or meet the standard; analyzes equipment utilization; conducts lengthy —sometimes all day—time studies; estimates direct labor cost on proposed products; develops layout of individual work areas; analyzes direct labor advantages of equipment being considered for purchase; develops machine capacity charts; assists in job evaluation program; assists in scheduling and machine loading, keeps record of percentage makeout on each rated operation; helps to develop layout of plant, helps settle grievances where standards are in question.

The products manufactured by the firms surveyed are:

Product	*No. of Firms*	*%*
Metal	15	60
Electrical	3	12
Foods	3	8
Rubber	2	8
Wearing Apparel	1	4
Paper	1	4
Pharmaceutical	1	4

The union status of the firms surveyed was:

Status	*No. of Firms*	*%*
Unionized	23	92
Not unionized	1	4
Partially unionized (10% or less)	1	4

The time study experience of the average time study engineer in the plants surveyed was found to be:

Years Experience	*No.*	*%*
1	1	4
2	2	8
3	1	4
4	3	12
5	4	16
6	1	4
7	4	16
8	4	16
9	0	0
10	2	8
11	0	0
12	2	8
13	0	0
14	0	0
15	1	4

The training background of the surveyed time study engineers was:

Training	*No.*	*%*
Combination of formal and on-the-job training	18	72
On-the-job trainining only	6	24
Formal training only	1	4

The following indicates the jurisdiction or area of operation to which the surveyed time study engineers were confined:

Jurisdiction	*No. of Firms*	*%*
Plant wide	15	60
Specific departments	7	28
Specific operations	1	4
Specific products	1	4
Multiplant	1	4

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What Does Industry Expect Of The Industrial Engineer?

By H. R. Werkheiser

Chief Production Planner, Aluminum Company of America, as presented to a Conference of Student Chapters of A.I.I.E., Knoxville, Tennessee, May 4, 1951

The subject "What Does Industry Expect of the Industrial Engineer" is susceptible to many interpretations, and certainly I cannot presume to speak for all industry. Actually, industry is a collection of individuals, each with his own ideas and concepts and prejudices, with many differences of attitude and interpretation. I can only give you my own personal impressions based on observation, experience and study. I cannot hand you a ready-made formula, nor a set of tools which will assure you of success in your chosen profession. If you have not gained a reasonable working knowledge of the tools of industrial engineering in your four years of collegiate study, certainly you are not going to be masters of these tools at the end of this meeting. It is of the application of these tools or techniques that I choose to speak, rather than of the tools themselves. No matter how good the tools, they will serve your purpose only if they are used properly, much as an artisan uses the tools of his trade. A *good* carpenter may build a fine house or piece of furniture even though his saws and plans are old and dull, but a *poor* carpenter, even with the finest tools, will not turn out a high quality finished product.

Your contribution to industry may lead either to specialized activities, devoting increasingly more time and effort in the direction of becoming more and more expert in the use of one particular management tool, or on the other hand, to more generalized responsibilities in which you will need some background knowledge of many or all of the tools of management, although perhaps not particularly expert in the use of any single one. You perhaps have heard the contrasting definitions of the specialist and executive. The specialist learns more and more about fewer and fewer things until he knows all about nothing, while the executive learns less and less about more and more until he comes to know nothing about everything. Whatever the direction of your activities, whether in a specialized or general field, there are certain attributes that seem to me of particular significance—each is in the direction of sound human relationships, and will help you in effectively applying the industrial engineering techniques that you have learned. It is coming to be recognized that we have *not* matched our progress in material aspects of our industrial and economic life with equal progress in the art and science of human relations. The emphasis is shifting from things — from materials, tools and equipment — to people. If we are to reap the full benefit of what might be termed our mechanical progress, we must solve these human relations problems. I cannot overemphasize that industry expects you, as industrial engineers today, and as potential managers of business and industry tomorrow, to recognize the top priority needed in the field of human relations.

Of course industry will expect many things from you: health, clean personal habits and appearance, self control, intelligence, initiative, and technical competence, the ability to think, to observe, analyze, decide and act But all of these seem obvious, and have been emphasized through many mediums. I should like to call your attention to some of the less publicized and less obvious, but none the less vital, attributes in meeting industry's need for improving its human relations, and in the application of the techniques of industrial engineering.

The first is an *objective* approach. If a football team is to score, it must know where the goal line is. Of course, other things are needed, too, but that is the first requirement—never lose sight of your objectives or of those of the organization for which you work. Industry will expect you to apply the principles and methods that you have learned in accomplishing its objectives, which for most industries may be broadly defined as a better product at lower cost at the time it is needed. Generally speaking, it is not interested in highly theoretical or elaborate methods per se; in other words, unless they can be applied in a practical manner to accomplish the desired objective. Industry will expect you to encourage and inspire cooperation and the best efforts of your associates and those working under your direction. People work more intelligently and more willingly when they know the objectives, and the reasons for them, and for the methods used. *Make sure that the people with whom you are working know what you are trying to accomplish, and why.*

The second attribute I wish to emphasize is *responsibility*. As industrial engineers and potential leaders, you must have a strong and active sense of responsibility, of integrity, sincerity and fairness. In these terms I include intellectual honesty, willingness to give credit to the other fellow when due, and to accept your fair share of the blame for failure, to present your ideas impartially without bias, and to avoid "bootlicking" or "apple polishing." If you expect to command the confidence and respect of your associates, and, as a representative of the organization with which you are identified, of your customers, and the general public, you must deal with them fairly, honestly and sincerely; in other words, with a high degree of responsibility.

The third attribute is *leadership*. People can be forced into putting in time and a limited amount of energy and skill, as is done in the slave labor camps of Soviet Russia, but if you want people's confidence, and expect their initiative and enthusiasm, you must earn it. One of our military leaders compared the American soldier to a piece of string; you can lead him anywhere, but you can't push him an inch. This applies to free Americans generally. Don't forget that Americans are free, and as free men they like recognition. They have pride in their jobs and in their contribution to our standard of living. They like to be consulted, and feel that they have some part in determining the direction of their effort. Whatever his job or rank, the worker needs a sense of accomplishment, a feeling of personal worth, and a realization of the true contribution of his effort in the broad scheme. A more democratic approach is replacing the outmoded authoritarian approach in business and industrial life. Today the emphasis is on selling rather than forcing, on a genuine interest in people. Organizing and controlling

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THE INDUSTRIAL ENGINEER IN AUSTRIA

By Ludwig Weber

Honorary Docent, Montanistic University, Leoben, Austria

Ludwig Weber is one of a group of prominent Austrians studying the organization of industrial engineering curricula at Georgia Tech under a Mutual Security Agency project. He is an active consulting industrial engineer in Austria, as well as a teacher of industrial engineering subjects. The editors have persuaded Mr. Weber to prepare a short report to present some of his observations of industrial engineering development in Austria.

The first difficulty encountered in a presentation of this sort is in defining the scope of Industrial Engineering activity, and in drawing lines between industrial engineering and other disciplines. Since this report is not intended to be an analysis of meanings and terms, the statement will suffice that the persons and offices who are really familiar with the subject tend to entrust similar duties to the industrial engineer in Austria as in the USA.

There can be no doubt that much has yet to be done in disseminating information on the nature and necessity of industrial engineering—perhaps along the thoughts of Livingston[1] of Columbia University. There are still many who believe that the knowledge required for industrial engineering activities can be acquired satisfactorily by practical experience. There are also those who believe that common sense—which is a term so frequently used as a handy excuse for lack of knowledge and experience—is entirely sufficient to solve all problems of modern management satisfactorily. Unusually gifted men will be able to solve these problems even without special training. However, these men comprise only a small portion of the men active in industry and business, and their number is unproportionate to the task to be dealt with. Furthermore, it is not the most efficient nor effective method if the individual has to work out his own solutions and develop his own techniques without benefit of the experiences of others.

Unfortunately there are a number of persons who do not see or who do not want to see the problems, the presence of which has necessitated or will necessitate industrial engineering.

Considering the huge task that must be undertaken in spreading the "gospel" of industrial engineering, it is a consolation to know that Austria is not alone. There are many other countries is which much is yet to be done in this respect.

The theme of this report perhaps can be best clarified by an analysis of those in Austria who solve the problems peculiar to the scope of industrial engineering. At this point it is yet irrelevant whether graduate industrial engineers are available or not since the task must be solved somehow. The following possibilities exist:

1. *The man on the job without previous industrial engineering.* It need not be proven to American experts that the untrained man will produce many ineffective and erroneous results, thus wasting manpower, time, materials and money.

2. *The engineer who is trained on the job in Industrial Engineering Techniques.* The engineer who did not gain industrial engineering knowledge in school can acquire it after completion of his engineering studies either by his own initiative, or by assistance from his employer or by institutions. The latter type of training appears to be the most common at the present time. The most important opportunity for schooling are courses, mostly of the night school type, offered by government institutions interested in increasing Austria's productivity, and by Universities. In these courses, which offer 20 to 60 hours of instruction, individual industrial engineering subjects such as motion and time study, cost accounting, scheduling, etc. are taught to beginners and advanced students. The schooling for the "job engineer" (job study and time study specialist) has the highest enrollment.

In the past, "job engineering" was concerned primarily with time studies as an aid in setting piece rates, but the developments of the past several years shows a definite trend towards special consideration of the human factor. The attempt is to design the job in the best possible way. Increasing attention is also paid to the relationship of industrial engineering and cost accounting.

These courses, which frequently issue certificates of attendance, also admit students without previous engineering education. Workers, and especially shop stewards, make frequent use of this opportunity. One of the reasons for this wide admittance is the idea that the more persons in industry that are familiar with industrial engineering subjects and their fair application, the more advantageous it will be for the increase of productivity.

The participation of industry is twofold. One, industry enrolls employees, supervisors, and sometimes executives, in the aforementioned courses; two, firms train their personnel on the job.

Big companies, primarily in the metal producing and machine industries, frequently have their own experts available for the training of beginning industrial engineers. More recently, some progressive companies have been offering a broad appreciation type of training in individual engineering subjects to their employee groups.

3. *Academic Education.* Here again, several types of training can be distinguished:

(a) Education on the medium level of engineering schools (Technical Institutes). These schools offer an engineering schooling in five years, between the ages of 15 and 20. The future engineer or technician (mechanical, electrical, etc.) is acquainted with the practical aspects of industrial engineering to a limited extent, but there is no special industrial engineering training.

(b) Schooling at the University level (Institutes of Technology) as related to the common engineering fields (mechanical, electrical, etc.). Normally, successful attendance requires a minimum of four years between the ages of 18 and 22, not including the acquisition of a Doctor degree. A series of courses are offered, such as accounting, safety, economics, motion and time study, organization for production, etc. The objective of these courses is to inform the student of the main subjects of industrial engineering and to acquaint him with their interrelationships.

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[1] Livingston, R. T., "The Industrial-Management Engineer and His Place in Society," Mechanical Engineering, March 1951

WANTED: SUCCESSFUL EXECUTIVES

By Leonard E. Cordes

Cresap, McCormick and Paget

Because of the present high level of business activity, there is no subject causing greater interest with top management people than executive appraisal and executive development.

The problem today, as I see it, is an insufficient number of competent executives available for the requirements of government, industry and other organizations. As of this moment, for example, I am very certain that you know of companies wanting new presidents, new general managers, or new department heads. Why are these men wanted? The answer is sometimes for expansion, but more often the need arises because of replacement, promotion, retirement or death. The emphasis is on replacement. The problem facing many companies, and the problem I shall discuss here is: *What kind of environment makes for executive success, how do we identify executives likely to be successful, and how can we assure an adequate supply of competent executives fo rthe future?*

Forgetting, for a moment, the individual executive, I would like to comment briefly on three factors which, if present in a situation, will assist materially in insuring that an executive with potential will be a success. In fact, a lack of these favorable conditions can cause an executive with outstanding potential to fail. These three factors which we find present in most companies enjoying long term business success are: 1. *A specific business objective;* 2.*A sound plan of organization to accomplish the objective;* and 3. *Competent incumbents in each key position.* Let's discuss each of these separately.

1. A man is more likely to be successful in a company or an operation which has clear cut, defined objectives and reasons for being in business. This fact may appear to have little significance; however in an examination of many businesses, one finds those companies which have established no specific goals in this respect, do not fare nearly as well as the companies which work according to a plan; and an executive's success, of course, is directly related to the success of his company.
2. Once the objectives of the firm are clearly established, it is essential to have a sound plan or organization to enjoy maximum success. One might compare the organizational chart for business to the organization chart of a ball team. There can only be one manager, one captain, and one key man for each position or function in the organization. If the organization is to function effectively, there can be no overlapping of responsibilities and there must be clear definitions of authority and responsibilities.
3. Once the purpose and objectives of the organization are decided and a sound plan or organization for fulfilling these objectives is evolved, it is imperative to have the best possible incumbents for each key position. A good executive, in a single key job, cannot do a good job by himself. He must have competent superiors, associates and subordinates. A good apple cannot survive very long in a box of rotten apples.

Given an environment conducive to executive success, we are next interested in finding executives who are likely to be successful.

How do we choose key men who are likely to succeed? What do we look for?

In non-executive positions, technical skill is high on the list in order of importance. It does not necessarily rate first in the case of executive positions. In evaluating executive ability our interest centers on the following major areas:

1. *Managerial Skills and Know-How*—such as the ability to plan, organize, direct, lead, decide and control.
2. *Personal Attributes* — including physical, mental and personality traits.
3. *Capacity for Growth*—Even in the case of choosing a man for the top job in a corporation, capacity for growth is most important since the Board of Directors is anxious to have an incumbent who can grow with the company and take on increased responsibility.
4. *External Activities and Influences*—Since a key executive has control over large operations it is essential, of course, that he not be held back by other business affairs, social activities, bad family circumstances, drink, or the like.
5. *Technical Skill*—This factor is probably not only last on the list, but also of least importance in considering the over-all requirements for a successful executive. Granted, a man should normally be proficient in one or two technical areas — what is more important, however, is that he be a good generalist and that he be able to comprehend more than he understands personally in technical areas.

In examining each of the foregoing major areas of interest, the greatest effort should be devoted to identifying traits which are common to successful executives, and traits which are common to unsuccessful executives.

The successful executive is often characterized by the following traits:

1. From a physical point of view, the successful executive is dynamic and full of energy. His physical makeup is such that he can endure the strain of pressure and frequent long hours of work.
2. He has an orderly, decisive mind, and a very high capacity for independent thinking. He is able to reach decisions, even though the time required to do such may be long or short—the important fact is that he is always able to make a decision.
3. From an intelligence level, he usually stands in the upper one-third of his class in high school and college.
4. He is realistic and practical, yet highly imaginative from the standpoint of new ideas and better ways of doing things.
5. He accepts authority without resentment. He is objective and

suspends judgment if all the facts are not available.

6. He is enthusiastic about his work.
7. He is eager to assume responsibility, in fact is always preparing himself for the specific job ahead. The individual who is a "comer" is well described by the old phrase:

   "He earns his living working in the daytime;
   he earns his promotions by night work."
8. He is motivated by the drives of achievement, pleasure of accomplishment, material reward, and prestige. The first two drives—achievement and pleasure of accomplishment — are usually stronger forces than the others.
9. He is a persistent individual and a hard worker.
10. He is articulate and to the point.
11. He has a stimulating personality—is usually humble, gracious, reasonable and considerate, but is a good disciplinarian.
12. He has a proper sense of time values, and $25 matters are not given the same time as $25,000 matters, as is often the case with unsuccessful executives.
13. He organizes effectively. He knows when and how to delegate authority and does so to the maximum degree practicable with the situation.
14. He works and plans on the basis of a good offense rather than on defensive action; for example, you usually don't find him taking care of troubles, because he has followed the course of preventative planning, and troubles are minimized.
15. Finally, the successful executive works well with others. It is important to note that he has an ability, not only to work with others, but he does so in a way which furthers the interests of his organization and, at the same time, satisfies the group which he leads. This distinguishes him from the individual who is simply gregarious and gets along well.

The unsuccessful executive, on the other hand, has traits, many of which are the exact converse of those possessed by the successful executive:

1. He does not have an orderly mind, and is unable to analyze and choose the best course of action. His mind is cluttered by detail.
2. He fails to accept responsibility, in fact he often fails to perform his own job adequately, and seldom attempts to take on responsibility beyond the scope of his present job.
3. He frequently wishes that he was someone else. For example, he would like to be his boss or someone who carries a position of high prestige.
4. He has an unconscious desire to do something other than his present work.
5. He is unable to take criticism or consider dissenting points of view. Prejudices interfere with good judgment. Lacks objectivity.
6. He shows resistance to authority above him, and does not accept it as necessary in the scheme of things.
7. His ambition is ahead of his ability. He is unwilling to learn intermediate steps and in anxious to move ahead fast when it comes to promotions.
8. He discourages suggestions and ideas from subordinates. He seldom listens. He wants it known that he is the boss. He is arrogant with subordinates and uses power instead of persuasion and other sound human relations techniques.
9. He emphasizes the errors of subordinates, instead of praising their accomplishments. He undermines the sense of security of subordinates by building up in them the fear of getting fired. He will let them guess on their performance instead of telling them how they are doing.
10. He gives conflicting orders.
11. He fails to delegate authority and responsibility.
12. He does not establish goals or standards of performance for himself or his subordinates.
13. He tends to keep his plans to himself, rather than share them with his associates.
14. He often has mental ailments, such as mood swings, and feelings of depression.

Once we know what to look for in an executive, how do we find the answers? It has been my experience that candidates for routine jobs can be successfully screened through the use of various test batteries. The more complicated a job becomes, however, the less valuable one finds tests in measuring the factors of probable success. Since executives represent the top of the scale, relatively little has been done, comparatively speaking, in developing infalible test batteries for executive selection. There are certain tests which are very helpful in determining intelligence and personality traits. Examples are the Purdue Adaptability Test (Intelligence Test), and the Thematic Apperception Test (Originated by Harvard and redesigned by the Committee on Human Development at the University of Chicago). In general, however, evaluation of executive potential, in my judgment, is still largely a matter of carefully interviewing the individual concerned, plus thorough checks with neighbors, acquaintances, superiors, former employers, subordinates and associates. A consistent high score in accurate appraisal of executives is very difficult to achieve because of the large number of factors involved, and the wide variables present in each of these factors.

It is not enough to know how to obtain, appraise and select executives with good potential from outside our companies, because of supply of good executives is nowhere near the present demand. It is probable that even in times of depression the supply of outstanding executives is inadequate. Since demand far outweighs supply, we are not solving our problems by moving executives from one company to another. It may solve a specific company's problem, but from the standpoint of the country as a whole, the problem is made more complex. The real answer to this situation is for all organizations to spend greater effort in developing and training individuals who appear to have good executive promise.

As you know, some companies have made progress in developing present and future executives: Larry Appley, of the American Management Association, is doing an outstanding job in furthering techniques in this area. Universities, such as Harvard and Michigan, are contributing their part, and many individual companies are well known for their efforts in this direction. For example, George Corless, at Standard Oil Company of New Jersey,

is doing a noteworthy job; Jim Worthy, of Sears Roebuck, has done much in this field; Earl Planty at Johnson & Johnson, has not only done a good job for Johnson & Johnson, but has passed along to many other companies his experience. Dick Crow of U. S. Rubber, has done a fine job; Chuck Foreman of United Parcel, has done some pioneering work in this direction: and, of course, we have all heard of the experience of the spice company in Baltimore, Maryland, in Multiple Management. Charles McCormick is president of this company which bears his name.

All companies, I am sure, can profit from long-term programs of executive development. Methods and techniques will vary from company to company, but, in general, will include basic approaches such as: individual counselling, psychological guidance, committee assignments, practice in role playing techniques, actual on-the-job experience in "assistant to" jobs, or through planned job rotation, attendance at conferences and University-sponsored management courses.

In my humble opinion, every dollar we spend over the years ahead improving the techniques of organization planning, executive appraisal and executive development, will be returned manyfold. Because of the close identity of today's executive, not only with his company, but with affairs of his community and government, I am convinced the future stature of the United States will be significantly related to the future job done in the areas of organization planning, and selecting and developing an increasing number of competent executives.

AUSTRIAN I. E.

(Continued from Page 11)

The number and content of the courses varies from one University to the other. The number of course hours is usually of secondary importance. Vienna Tech and Graz Tech offer these courses partly as electives, whereas the School of Mining (Leoben Tech) requires these courses.

(c) The "Engineer of Economics" at Graz Tech. Five years ago Graz Tech established a curriculum for "Engineer of Economics." The first two years of study coincide with that of the other branches of engineering, and form a basis for later specialization. The last two years actually cover the special areas of education in the field of "Engineer of Economics," which is similar to the American Industrial Engineering. The major difference lies in the less intensive treatment of the factors of manufacturing (time and motion study, scheduling, production control, industrial planning, etc.), or in making these subjects electives. The subjects of business law, business management, accounting, and economics are accentuated. However, the student is required to attend a number of purely technical courses during his last year in order to acquire as thorough a knowledge as possible of the technical subjects.

(d) The University of Commerce of Vienna. (Business, economics, etc.). The education offered by this institution, of which accounting, selling, cost accounting, should be mentioned here, can be acquired by an engineer only by an additional four years of study beyond his engineering training. This combination is, of courses, rare.

Without wishing to disregard developments, it can be stated that academic as well as post-academic training for solving industrial engineering problems in industry will have to be intensified.

In addition to the education provided by our schools, the Austrian Productivity Center and the Austrian Council on Economy in Vienna promote, organize, and conduct courses. These same institutions are active in disseminating information concerning the advantages of Industrial Engineering. In both institutions, representatives of management and labor participate. The Productivity Center directs its efforts toward everything which contributes to the increase of productivity, i.e., information, training, study tours, plant surveys, consultation of foreign—especially American—experts, etc. The Council of Economy works primarily with various committees in establishing policies, preparing and issuing directives, manuals, etc. As an example, in 1951 a directive for cost accounting was issued which was intended as a guide for industrial enterprises to enable them to establish new systems or revise present cost accounting systems according to modern methods. Perhaps the Work Study Manual should be mentioned here, for it is of interest because it guides the practicing industrial engineer. The Manual was authored by a group of experts, and the book was issued by an institution formed in cooperation of government, management and labor representatives.

We should also mention the attitude that we wish the industrial engineer to develop during his formal training. We feel that the industrial engineer should not represent the interests of one group, but should serve as a link, as a mediator, by virtue of socially and humanly correct application of sound theoretical knowledge in the areas of industrial engineering. Unions also have contributed to this attitude by acquainting many of their shop stewards with the basic problems and methods of industrial engineering by means of clinics. This is particularly true in the nationalized industries.

This report would be incomplete if one forgot to mention that conditions in the economy of a small country are different from the economic conditions in America. Perhaps these differences mean smaller plants, greater individuality, less mass production, etc. Naturally, the American type of industrial engineering education will have to be adapted to suit these particular needs.

Austrian industrial engineering experts are proud to participate in international committees such as the C.I.O.S. They are fully aware of the advantages of exchanging ideas between nations, and are especially grateful to the American industrial engineers for many valuable suggestions.

PRESIDENT'S MESSAGE

(Continued from Page 3)

true professional. For it is very largely the recognition of this responsibility that defines the true professional.

The A.I.I.E. believes that Industrial Engineers are men endowed with special talents who have made or received the opportunity to develop these talents through experience and education. It believes that being so endowed they possess a special responsibility to society, their country, industry and their fellow man.

The trust inherent to the situation just described deserves protection and guidance. More especially today when influential groups in politics, government, labor, education, yes, and in commerce, industry and the professions are organized for the promotion of practices and ideals contrary to the good of the country and grossly at

(Continued on Page 16)

Today's Challenge to the Industrial Engineer

By James E. Trainer

Vice President in Charge of Production, The Firestone Tire and Rubber Co., as presented to the American Institute of Industrial Engineers, National Convention, May 19, 1952

Production is simply the creation of material things of value. It is these things or products, available in quantity at reasonable prices, that set our American standards of living apart from that of the rest of the world. Products of industry have brought increasing hours of leisure to increasing numbers of people. This leisure provides added opportunity for education or recreation and in time of war it constitutes the reserve strength of our nation.

I do not need to tell you how, despite increasing labor costs, American industry over the years has lowered prices while improving quality—how products once regarded as luxuries and once restricted to the rich have become necessities to practically every family in our country. If our country is to continue to prosper, this trend of more value for less money must continue. There can be no such thing as standing still. The only alternative is to go forward or slip backward.

Stated simply, our average standard of living might be determined by dividing total products available for domestic use by the number of people in the country. Regardless of differences of opinion about how the distribution is to be proportioned, it is obvious that improving the *average* can come about only through increasing the pool of goods and services to be divided. Therefore, it is certainly in the interest of all that each individual make his contribution to the pool as large as it reasonably can be made. To my way of thinking, anything that stands in the way of an individual's opportunity to make his full contribution, within the limits of healthful practice, is both wasteful and anti-social. Accordingly, it is necessary that we do several things:

We must constantly and critically study the work we do to make certain that the efforts being expended by our people are accomplishing as much as they should.

There is a tremendous potential for increase in productive capacity in our present labor force. I can offer no magic formula for realizing it. Certainly the problem becomes increasingly difficult with increasing numbers of employees. The farther men are removed from contact with top management, the harder it is to give them a sense of being on the team.

There is no substitute for the type of man-to-man relationship that should exist between first-line supervision and the people under their direction. It is my belief that every supervisor should be able to perform well the job he supervises; that he should try to get the other fellow's viewpoint; that he should have a nice sense of balance between being wishy-washy on the one hand and pig-headed on the other; and that he should be worthy of the respect of his fellow men. There is no more important phase of management's responsibility than the obligation to select supervision wisely and *train it well*. And I want to stress this point: training of supervision is never finished. It must be a continuing process that refreshes over and over again the ability, desire and determination of every supervisor to be a good boss.

Production for war presents to many of us the need to shift gears. Such a shift may be merely to increase output of accustomed lines, or it may be to different products entirely.

We must strive ceaselessly to eliminate waste motion. We must ask ourselves over and over, "Is this operation really necessary?" And we must exert the mental effort necessary to discover why it may not be necessary or how to make it unnecessary, and then take the action that is indicated.

We must reduce progressively the wastes resulting from poor scheduling of work, improper maintenance of machines, inadequate inspection of materials being supplied to workers, and handling which adds nothing to the product except cost.

We must resist "featherbedding" in all its forms. Now you probably think, as most people do, that "featherbedding" is a practice confined to labor. I consider that it is also practiced by European type trusts or "Cartels" when they fix prices and quality and when they assign exclusive sales territories so as to avoid competition between their members. I consider that "featherbedding" is practiced by Government when any official's family or political henchmen go on Government payrolls for performance of mythical or non-essential duties; or when bureaus, departments or offices established for emergency purposes remain in existence beyond their useful life. "Featherbedding" is repugnant to Americanism, whether practical by Government, capital or labor. The ends are the same—somebody gets something for nothing while the consuming public foots the bill or while the price of a needed commodity is driven beyond the point where many would-be customers can afford it.

At all times it is the responsibility of all of us engaged in production to see that Americans will continue to enjoy the products of industry at prices which they can afford. Today another challenge confronts us, that of doing a job of re-armament, possibly fighting and supplying a war, with the man power which we have available to us. To illustrate, let's do a little stock taking on the manpower situation.

Only a few years, planners were speaking wishfully of sixty million jobs. Late in 1951 we found civilian employment alone in excess of sixty-two million. We found that the ranks of the unemployed had been thinned from eight million in early 1940 to around 1,600,000. I repeat — and compare these figures closely — unemployment was reduced from 8 million in early 1940 to around 1,600,000. Most of you remember very well the critical manpower shortage which industry faced throughout World War II, a war which was begun when we had a reservoir of unemployed that was five times as great as it is today.

Furthermore, the birth-rate factor has been against us. The *low* birth rate of the 1930's reduced the number of 18-year olds coming into the labor market each year. The *high* birth rate of the 1940's has placed heavy demands of motherhood on young women who might otherwise join the labor force.

Now this picture is not as dire as it seems at first glance. Today we have more plants, and plants are more fully manned than in 1940. And our 1951 work week averaged less than 41 hours in manufacturing. Never-

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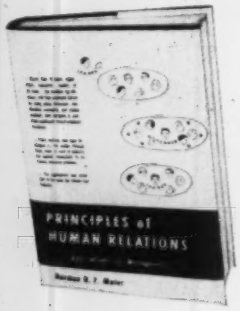

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theless, if we have to fight World War III, we are going to have to stretch our man power resources to the utmost. Toward this end, I believe that we have a responsibility to adapt jobs, in whole or in part, to performance by women, by youths, by the physically handicapped, and by the aged. For example, during World War II, Firestone employed a large group of blind workers. With their help, we designed the special forms and tools which they used for cutting and assembling by sense of touch. They did a good job.

Today many of us are entering fields that are new. Because they are new, they are especially fertile for the development of new ideas, new methods and new equipment to increase output per man hour.

Therefore, we must scrutinize even more constantly than usual the job methods employed.

I am sure all of us remember how the demand to produce for World War II hit us with sledge-hammer impact. Time was our greatest need.

Today we have warning of things to come. Whether they will come, or when they will come, only the Kremlin knows. There is a growing feeling, however, that Russia intends to win the "Cold War"—if she can—without fighting a hot one. Certainly, continued reckless spending of our substance and waste of our man-power could mire the United States in socialism and bankruptcy.

Every American has a responsibility to fight this waste. Specifically, so far as you and I are concerned, we have an obligation to proceed on a business-like basis. Such a basis requires that we *do not* hoard labor. It requires that we *do* do these things:

Study all new jobs carefully and engineer them for the right number of workers;
Provide clear-cut methods for the performance of every job;
Train workers to perform each job on the manpower basis for which the job was designed; and
Establish reasonable standards of performance and insist upon their being met.

If we are to accomplish these ends, we must *not* put on any job any more people that it requires—not even for the time required to get a new job running smoothly.

We must not teach people how to "featherbed," for more labor problems start from trying to take excess people off jobs than most any other such thing.

Despite the critical need for conservation of man-power, there are at least two strong temptations to hoard labor:

First, like the old "cost-plus-percentage of cost" contracts, high taxes on profits relieve industry of much of the cost of hoarded labor.
Second, the uncertainty as to what man-power requirements will be on new and unfamiliar products is an inducement to add a margin of safety.

The *easy* way—the lazy way—to do the job is to be sure you hire ample man-power. But I say to you that doing so is "featherbedding" by management.

In summary, then, it is my conception that today's challenge to the Industrial Engineer—in his professional capacity—is two-fold:

to promote the economic development of our country by continued improvement upon methods of production of civilian goods; and—
to obtain maximum efficiency in the use of man-power on products for defense of our country against armed aggression!

PRESIDENT'S MESSAGE

(Continued from Page 14)

variance with the objective scientific approach and solution of the Engineer.

Are Industrial Engineers willing to meet this challenge in a spiritless, disorganized fashion? Are they content to sit back while their country and its institutions are eroded to destruction by unsound policies and practices that lie properly within their influence and obligation to correct? Will they, in short, continue in their refusal to accept, as a unified integrated profession, their responsibility to society? The A.I.I.E. thinks not and is proving this belief. There is very great interest in A.I.I.E. today and its offer of professional unity. Each day adds new members. Each month organization begins on one or more new chapters.

The American Institute of Industrial Engineers is the professional society for Industrial Engineers. There is no similar national group for Industrial Engineers. Its objective is distinct and different. It is a basic necessity to the professional Industrial Engineer and to the unity and guidance of his profession.

TIME STUDY DUTIES

(Conitnued from Page 9)

The companies surveyed were not in agreement as to the title of the employee who functioned as a time study engineer, as shown by the various titles used.

Title	No. of Firms	%
Time Study Engineer	11	44
Time Study Man	4	16
Methods Man	2	8
Time Study and Industrial Engineer (used synonymously)	1	4
Process Engineer	1	4
Personnel Director	1	4
Industrial Engineer	1	4
Time Study Observer	1	4
Engineer, Electrical or Mechanical Manufacturing	1	4
Time Study and Methods Engineer	1	4
Standards and Methods Engineer	1	4

The duties likely to be assigned to time study personnel in the twenty-five firms surveyed were found to be:

Duties and Responsibilities	No.	%
Analyzes own time studies and establishes rates	25	100
Conducts *stopwatch* time studies	24	96
Determines best methods for operations	21	84
Develops standard data charts	20	84
Analyzes material handling problems	20	80
Investigates causes for subsidization where operation fails to make day rate	20	80
Analyzes equipment utilization	19	76
Conducts lengthy—sometimes all day—production checks	19	76
Investigates causes of excessive down time	19	76
Estimates labor costs on proposed products	19	76
Lays out individual work areas	19	76
Develops machine capacity charts	18	72
Analyzes direct labor advantages of equipment being considered for purchase	17	68
Assists in scheduling and machine loading	10	40
Maintains record of % standard earned on each rated operation	10	40
Assists in job evaluation program	9	36
Develops plant layouts	9	36
Settles grievances where standards are in question	9	36
Analyzes suggestions from suggestion system and determines potential savings	3	12
Conducts foreman and supervisory training programs in time study and wage administration	3	12
Conducts management surveys and organizational analyses	3	12
Develops production or process planning such as tooling, equipment, specifications, etc.	3	12

Some general characteristics of the twenty-five firms surveyed and their use of time study are:

Products Manufactured	Number of Time Study Engrs. per Co.	Total Employees per Company	No. of Employees on Rated Jobs	Average No. of Employees on Rated Jobs per Time Study Engineer	Standards Used for Incentive Payment (A)	Standards Used for Measured Daywork (B)	Use of Standards is Combination of (A) and (B)	Standards Used for Std. Cost & Efficiency Check Only
Metal	1	82	25	25	x			
"	1	350	250	250		x		
"	1	800	500	500		x		
"	1	850	700	700	x			
"	2	370	90	45	x			
"	2	1450	150	75		x		
"	3	1500	1000	333		x		
"	4	1200	900	225	x			
"	5	500	275	55	x			
"	6	850	550	92	x			
"	6	1200	900	150		x		
"	7	1700	688	98		x		
"	7	3000	3000	429		x		
"	8	2700	1400	175	x			
"	11	3474	1542	140	x			
Electrical	6	3600	2100	350		x		
"	21	4186	1716	82	x			
"	32	4000	4000		x			x
Foods-Meat	4	2500	2000	500	x			
" -Canned Goods	10	15000	15000				x	
Rubber	2	1200	580	290	x			
"	4	1300	1000	250	x			
Apparel	3	450	350	117	x			
Paper	4	1000	1350	338	x			
Pharmaceutical	40	5000	5000	125			x	

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INDUSTRY EXPECTS

(Continued from Page 10)

people as a group is a science, but reaching individuals is an art. In order to persuade people to do what you want them to do, you must make them aware that they are an essential part of the activity; you must recognize them as individuals and as members of the team, giving them a pat on the back when it is deserved, and, if you must criticize, do it in private. Don't belittle or embarrass your associates or those working under your direction. Let them know the importance of their activities; develop their pride; try to inspire them to a higher level of attainment; provide motivation or incentive to develop their best efforts. If you as individuals, and the industries with which you become associated, are to benefit from the industrial techniques that you have learned, you will do it not alone because of your knowledge of these techniques, but rather because of the manner in which you apply them. That application will be immeasurably simplified if you can *lead rather than drive* people into their acceptance.

In summary, if you remember that *productivity* is the key to our national security and our standard of living, and to the success of the companies with which you become affiliated, and if, in the application of the industrial engineering techniques that you have learned, you maintain at all times an *objective* approach, high ethical standards, a deep sense of *responsibility*, and develop to the fullest your *leadership* potential, I am sure that you will go a long way toward meeting industry's expectations of you as industrial engineers.

OFFICE W. S.

(Continued from Page 8)

passed quickly, with no claim of any influence of our subject on it. It is possible in large organizations transfer could be made to fit to adaptable type of work but it may be considered questionable. We'll be fair and say no credit.

5. *Practice of Informing Employees of Their Job Status (both their successes and failures):* Work Simplification determines How to do, the best way to do and from it comes standards of performance. When practiced, supervisors and employees both get to know quality and quantity of work to be procured and How to procure it. From the employee's viewpoint there can be self stimulation because he knows what performance is expected and when performance is discussed by a supervisor, there is no question of interpretation nor fairness.

Now to wrap this up. The reasons why are numerous — both tangible and intangible. To my mind they are so important that they don't need justification.

"Why Work Simplification in the Office"? I'll answer that with a two-word question: "Why not"?

STOP WATCH ACCURACY

(Continued from Page 6)

the visual stimulus. This information has been regrouped and summarized in Table 2. The snap-back method appears to be more accurate than the continuous method for timing short elements, but the average percentage error for all of the continuous method readings is slightly less than the average percentage error for all of the snap-back method readings.

Well, what does this mean? A reasonable and practical interpretation would be that accuracy can be obtained by both the snap-back and the continuous methods, but only if sufficient cycles are timed in order to statistically control the variability caused by the characteristics of the decimal-minute stop watch and its use by experienced observers. Further, the proponents of the continuous and the snap-back methods of recording time study values might reconsider their claims concerning the accuracy of their favored procedure, and perhaps be more tolerant of other procedures.

TIME STUDY DUTIES

(Continued from Page 17)

The engineers interviewed were asked to name up to five jobs held prior to entry into time study work. The jobs mentioned were grouped into general areas of endeavor.

Job Title	No.	%
CLERICAL POSITIONS		
Clerical worker	6	24
Production Control	5	20
Stock room clerk	3	12
Time keeper	2	8
Accountant	2	8
Material Control	1	4
Of possible total of 25 interviewees, 9 have held clerical jobs.		
MACHINE OPERATOR OR SHOP WORKERS		
Machine operator	9	36
Heavy Assembly	2	8
Laborer	2	8
Apprentice tool maker	1	4
Repairman, radio	1	4
Machinist	1	4
Of possible total of 25 interviewees, 15 have been operators.		
ENGINEERING POSITIONS		
Mechanical engineer	3	12
Material and Cost estimating	3	12
Civil engineer	2	8
Plant layout	2	8
Process engineer	2	8
Methods engineer	1	4
Tool designer	1	4
Management consultant	1	4
Of possible total of 25 interviewees, 11 have held engineering positions.		
SUPERVISORY POSITIONS		
Clerical supervisor	2	8
Receiving and shipping supervisor	2	8
Maintenance foreman	1	4
Salvage and redistribution supervisor	1	4
Shop supervisor	1	4
Foreman	1	4
Restaurant proprietor	1	4
Bakery proprietor	1	4
Of possible total of 25 interviewees, 6 have held supervisory positions.		
SALES POSITIONS		
Sales	5	20
PERSONNEL POSITIONS		
Industrial relations	1	4
Job evaluation	1	4
MISCELLANEOUS		
Attorney	1	4

Short comings of time study personnel that were sufficiently severe to cause transfer or dismissal were:

	No. of Responses	%
FACTORS RELATED TO HUMAN RELATIONS		
Human relations—human engineering	10	10
Lack of ability to sell self and standards to operators and supervisors	9	36
Break down in prestige of time study engineer and the resultant labor difficulty	2	8
Lack of ability to deal with people and unions	2	8
Lack of sympathy and understanding of employees, employees' problems, and employees' viewpoint	1	4
Percentage of 25 supervisors who mentioned one or more factors related to human relations—72%.		
FACTORS RELATED TO PERSONAL PROBLEMS		
Personal problems—home life, emotional stability, and personality	5	20
Indifference and lack of interest	4	16
Lack of originality, progressiveness and common sense	3	12
Percentage of supervisors who mentioned one or more factors related to personal problems of T.S.E.—48%.		
FACTORS RELATED TO TECHNICAL PROBLEMS		
Failure to get sufficient data to justify proposal—lack of thoroughness	3	12
Lack of ability to analyze problems scientifically	2	8
Imbalance between theoretical knowledge and practical experience	1	4
Violation of fundamental principles of industrial engineering	1	4
Percentage of supervisors who mentioned one or more factors related to technical problems—28%.		
FACTORS RELATED TO MANAGEMENT		
Lack of management backing which results in loss of prestige of the time study engineer	1	4

Personal short comings of time study personnel, limited to inadequacies that could be remedied by further training, were indicated by answers to the question "In which areas, if any, do you find most time study engineers inadequately trained?

	No. of Responses	%
FACTORS RELATED TO TECHNICAL PROBLEMS		
Methods—basic work simplification	5	20
Performance rating	5	20
Basic arithmetic and fundamental mathematics	3	12
Development of standard data	2	8
Report writing	2	8
Lack of familiarity with predetermined elemental time standards systems, such as MTM, Work—Factor, Etc.	2	8
Inability to apply theoretical knowledge	2	8
Determination of feeds and speeds	2	8
Operator training techniques	1	4
Estimating direct labor on new jobs	1	4
Clerical accuracy	1	4
Balancing for group bonus and production lines	1	4
Inability to develop allowances for special fields of manufacturing	1	4
Percentage of supervisors mentioning one or more factors related to technical problems—76%.		
FACTORS RELATED TO HUMAN RELATIONS		
Human relations	6	24
Salesmanship	5	20
Personnel relations	2	8
Union relations, contracts, practices policies, functions, etc.	2	8
Percentage of supervisors mentioning one or more factors related to human relations—40%.		
FACTORS RELATED TO INADEQUACIES THAT ARISE DUE TO TIME STUDY ENGINEER NOT HAVING HAD EXPERIENCE ON THE OPERATOR LEVEL		
Practical experience in jobs to be studies	7	28
Actual experience as a machine operator to learn the practical end of machine operation and lack of knowledge of shop psychology	3	12
Percentage of supervisors mentioning one or more factors related to experience at operator level—32%.		
FACTORS RELATED TO PERSONAL PROBLEMS		
Lack of self-confidence	1	4

CHANGING CONCEPT

(Continued from Page 5)

must have sufficient good judgment to temper his enthusiasm and imagination so as to produce the desired results. This, of course, presupposes technical competence, that is, a mastery of the fundamentals required to solve a given problem. It seems to me that our industrial engineer of the future is going to develop personal traits that will do much to supplement technical competence in gaining the recognition and leadership that will make him a success.

8. The industrial engineer is learning how to get results through people—particularly through first-line supervision and the worker. All industry is learning that special consideration must be given to these two groups in order to obtain worth-while results. The industrial engineer too often thinks only of management objectives, whereas he must also consider the goals of the individual. By that we mean the goals of the foreman and of the worker. When goals of the individual are not satisfied he becomes disinterested, his production is poor, and the quality of his work suffers.

It often has been said that the top executive is the man who gets results through other people. Certainly the industrial engineer also is a man who gets results through others. He provides services and assistance to the line organization—to the superintendent and to the foreman who in turn uses the engineer's ideas in dealing with the workers on the line. Unless the industrial engineer can get acceptance of his ideas by these groups, his value to the organization is minor indeed.

Many workers in industry resent change. They tend to resist new ideas, especially when they come from a staff department. The industrial engineer is learning the value of encouraging supervisors and workers alike to originate changes and to call on engineering to aid in working out the details. When the line organization suggests the changes and takes the initiative in carrying out these ideas the work of the industrial engineer is much easier and more effective.

It is profitable in many cases to give some of the industrial engineer's tools and techniques to the supervisor and worker so they are in a better position to make worth-while changes. Systematic training in motion study and methods improvement is one of the accepted ways of doing this. Of course the industrial engineer will have to carry the main responsibility in connection with the solution of some highly technical and complicated problems, but even in such instances the engineer will do well to work with the line groups as he proceeds with the job.

With the proper relationship between the line organization and the industrial engineering department the supervisor and the worker can solve a multitude of problems with a minimum of help from industrial engineering. If the foreman originates a new idea concerning some activity in his own department, it is obvious that he is going to use all of his efforts in trying to make it work. The company benefits just the same whether the new idea originates with him or with the industrial engineer.

In this connection I would like to quote a statement recently made by Clarence Francis, Chairman of the Board of General Foods, at a meeting of the National Association of Manufacturers. He said, "You can buy a man's time, you can buy a man's physical presence at a given time; you can even buy a measured number of skilled muscular motions per hour or day. But you cannot buy enthusiasm; you cannot buy initiative; you cannot buy loyalty; you cannot buy the devotion of hearts, minds and souls. You have to earn these things. . . . It is ironic that Americans—the most advanced people technically, mechanically and industrially—should have waited until a comparatively recent period to inquire into the most promising single source of productivity: namely, the human will to work. It is hopeful, on the other hand, that the search is now under way."

Should not the industrial engineer be in the forefront of this movement? I believe the industrial engineer who in the past has made great contributions in increasing productivity through the application of engineering techniques will in the future see the opportunity of aiding in organizing things so that the worker will be able to satisfy his own personal goals and at the same time satisfy the goals of the organization. The effect will be a tremendous increase in productivity along with a tremendous increase in satisfaction on the part of all members of industry.